

Testing Bond Strength of Glue for Optimal Packaging packaging materials

The food industry has several challenges when it comes to packaging items for consumer use. Most important are protection during shipment from manufacturing plant to store and ease of opening the packaged item by the end user. Packaging materials are carefully selected for this purpose while observing budget constraints imposed by marketing departments. Choice of appropriate glues is one facet of this process. To ensure that candidate glues perform adequately, physical testing is needed to measure bonding strength on designated packaging materials. This article explains how to perform the required tests to evaluate different adhesive products.

Texture Analyzers have become popular tools used by food companies and their suppliers to test packaging materials. Figure 1 shows an example of this instrument. Modes of operation include compression to model pressing items together during the bonding process and tension for pulling items apart to simulate how customers open things up. Probes and fixtures can be attached to the instrument and apply the type of action that is required to evaluate the packaging material. For example, Dual Grips in Figure 1 secure the ends of a bonded material for a tension test that evaluates the force required to pull them apart.

In addition to choosing between many probes and fixtures for the test, technicians must also decide how quickly to perform the test. Control parameters include how fast to move the probe, how much distance to travel during the test, or how much force to apply. For the Dual Grips in Figure 1, it makes sense to exert as much force as the consumer would when trying to open the package. For the average person this could be between 5 and 10 kilograms. For children and senior citizens, it is probably less.

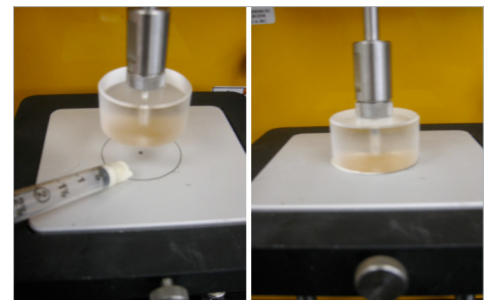
Easy operation, rapid test capability and useful data are trademarks of Texture Analyzers. The simplest method for evaluating glue performance is to apply a small amount to a test surface, press it together with the mating item, and then pull it apart. Figure 2 shows a simplified version of this process, called the "Quick Test", in a sequence of two images. The Base Table attached to the instrument has a surface on which the glue is applied. A cylinder probe makes contact and presses downward with a maximum force of 4000 grams. The probe reverses direction and the adhesive force needed to pull the probe away is measured. This straightforward test can be quickly modified to include a hold time for sustained application of the 4000 gram force.

Data recorded during the Quick Test is shown in Figure 3. Force load is recorded on the y-axis, time on the x-axis. The Peak Load is the maximum force of 4000 grams being applied to the glue on the Base Table. When the probe starts to pull away, negative force values indicate the adhesion between probe and table that must be overcome

Figures 1: Brookfield CT3 Texture Analyzer with Dual Grips for Tension Test on Packaging Seal



Figure 2: Quick Test for Measuring Bonding Strength of Glue



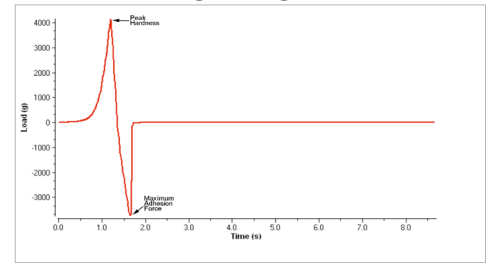
to achieve separation. This is equivalent to the tear strength required to separate apart two materials that have been bonded together by the glue.

The entire test required less than 5 seconds to execute. In practice, a hold time for application of the maximum force could easily be added to the test protocol. If the bonding process used in manufacturing allows for two mating surfaces to be pressed together for a short time interval, then the test method should mimic this procedure.

One important capability worth noting about the Texture Analyzer is that it can be used with a PC when characterizing glue performance, as seen from the graphical data in Figure 3. Once the R&D Department has formalized the test method, Quality Control can operate the instrument in standalone mode and simply record the maximum negative force for the output data. The objective is to verify that the glue has tear strength that falls within acceptable min/max values for consumer use.

Texture Analyzers are already in widespread use in food companies to measure the physical strength of baked goods, meats/fish, and semi-solid materials like creams/sauces. Now there is one more practical use for these versatile instruments to ensure that customers receive products that are not only well-packaged, but easily opened.

Figure 3: Graph Shows Data from Quick Test for Bonding Strength



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